

Additional Notes on *Hemicarabus macleayi amanoi* (Coleoptera,
Carabidae) Recently Discovered from the Island
of Rishiri-tô, Northern Japan

Yûki IMURA

Shinohara-chô 1249–8, Kôhoku-ku, Yokohama, 222–0026 Japan

Abstract *Hemicarabus macleayi amanoi* IMURA is redescribed based on totally fourteen specimens including the first male, with illustration and description of the larva. Some taxonomical and bionomical notes are also given.

Hemicarabus macleayi was discovered very recently from the alpine zone of the Island of Rishiri-tô in northern Japan, and sensationally debuted into the Japanese carabine fauna as a remarkable newcomer (IMURA, 2004). In the same paper, the Rishiri race was described as an independent subspecies named *amanoi*. However, only two female specimens were known until that time, and the next step to be made was to discover the male in order to reconfirm its taxonomical status on sounder basis. Besides, our knowledge was still too poor on the distributional range and habitat of this beetle on the island, as well as its ecological data. All these are needed to be brought to light, since they are indispensable not only for science but also to make careful consideration to conservation of this meager species. For this purpose, I visited the island again in the summer of 2005 and made a second survey of the species in the alpine zone of Mt. Rishiri-zan¹⁾. With the aid of four other members joined to the expedition, I have finally succeeded in collecting totally twelve specimens including the first male of *H. m. amanoi*, and obtained a fairly good result on the range of distribution and original habitat. In addition, I was able to clarify its life stage from the egg to newly emerged adult *in vitro*.

In the present paper, I am going to give a full description of the Rishiri race on both sexes, with illustration and description of the larva, which would be introduced into science for the first time at the species level. A brief comment will also be given on its distributional range, habitat, food and estimated annual life cycle.

For the application of the generic names, I follow the higher system proposed by myself (IMURA, 2002), and the abbreviations used herein are the same as those explained in previous papers of mine.

¹⁾This survey was performed under the permission of the Ministry of Environment (permission No. 050328002 of the West Hokkaido Regional Office for Nature Conservation).

Before going into further details, I wish to express my sincere gratitude to all the members of the 2005 expedition for their kind aid throughout my field work: Messrs. Yoshiyuki NAGAHATA (Yonezawa, Yamagata), Masahiko SATO (Rishiri Town Museum), Kazuyuki SHIOMI (Hannô, Saitama) and Naoki TODA (Nagoya, Aichi). Also I thank Mr. Igor BELOUSOV (Zoological Institute of the Academy of Sciences, St. Petersburg), Dr. Thierry DEUVE (Muséum National d'Histoire Naturelle, Paris), Mr. Mitsumasa KAWATA (Sapporo, Hokkaido), Mr. Kiyoyuki MIZUSAWA (Yokosuka, Kanagawa) and Dr. Akiko SAITO (Natural History Museum and Institute, Chiba) for their help in providing specimens for comparative study. Heartly thanks are also due to Dr. Shun-Ichi UÉNO (National Science Museum, Tokyo) not only for taking trouble to get a permission of my survey in the special protection zone of Rishiri-zan but for critically reading the manuscript of this paper.

This study will be presented at the 18th Annual Meeting of the Japanese Society of Coleopterology to be held in Kurashiki, 19–20 November 2005.

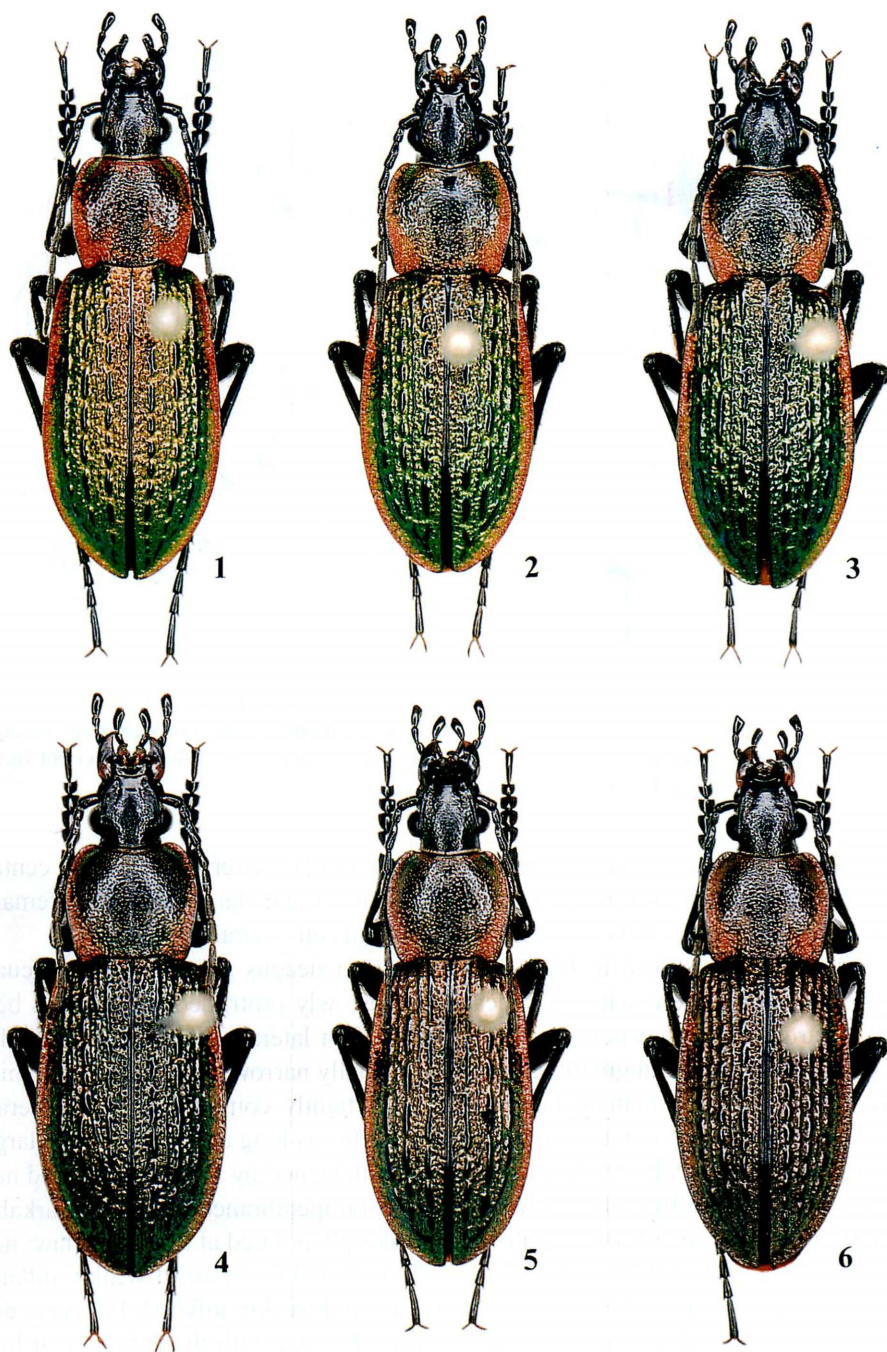
Hemicarabus macleayi amanoi IMURA, 2004

(Figs. 1–7, 14–20)

Hemicarabus macleayi amanoi IMURA, 2004, Elytra, Tokyo, **32**, p. 236; type locality: alpine zone of Mt. Rishiri-zan, on Is. Rishiri-tô, off the western coast of the northern tip of Hokkaido, Northeast Japan.

Male. Length (including mandibles): 16.40–17.10 (M 16.75) mm. Head black, usually bearing a faint coppery reddish or greenish tinge; marginal area of pronotum and elytra coppery red with a strong metallic lustre; pronotum excluding marginal portion black more or less bearing coppery reddish or yellow greenish tinge above all in bottoms of punctures and depressed part; elytra excluding the marginal areas metallically lustrous, with the coloration light to dark yellowish green often bearing a coppery reddish tinge along the sutural part, or sometimes wholly dark reddish coppery with a faint greenish tinge; elevated part of elytra almost black and rather strongly polished above all in fresh individuals; venter and appendages dark brown to brownish black.

Head as in female, though the antennae are a little longer, reaching the basal quarter of elytra; terminal segment of palpi not remarkably dilated, so that inter-sexual difference is hardly recognized. Pronotum a little slenderer than in female, 1.15–1.24 (M 1.22) times as wide as long, with the lateral sides gently arcuate throughout and hardly sinuate before hind angles which are more prominently protruded posteriad than in female and blunt at tips. Elytra much slenderer than in female, 1.65–1.75 (M 1.71) times as long as wide, 1.34–1.45 (M 1.39) times as wide as pronotum, and widest behind the middle; lateral sides before the widest part nearly straight or at most feebly arcuate, those behind the widest part roundly arcuate; primary intervals the strongest, indicated by rather regularly interrupted rows of short costae and prominently convex above; secondaries much weaker than the primaries, forming rows of short and narrow costae irregularly interrupted by small secondary foveoles, or longitudinally set rows of large granules; tertiaries the weakest, usually recognized as irregularly set rows of granules



Figs. 1–6. Males of *Hemicarabus macleayi amanoi* from the alpine zone of Mt. Rishiri-zan, showing individual variation.

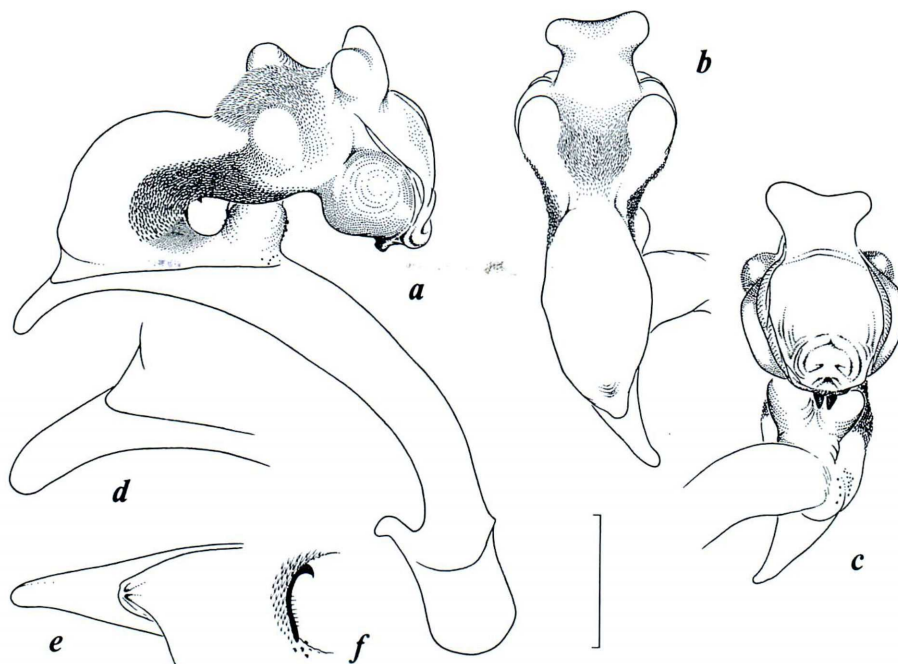
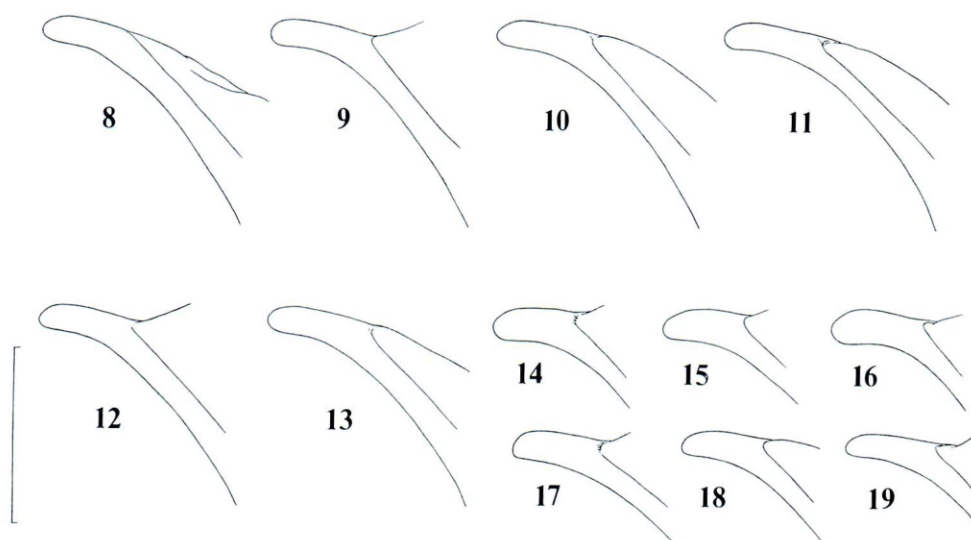


Fig. 7. Male genital organ of *Hemicarabus macleayi amanoi*. — a, Aedeagus with fully everted endophallus in right lateral view; b, ditto in view from aedeagal apex; c, ditto in view from aedeagal base; d, apical part of aedeagus in right lateral view; e, ditto in dorsal view; f, ligulum in right lateral view. Scale: 1 mm for a–c; 0.5 mm for d–f.

often confluent with the adjacent intervals to form reticular pattern above all in central portion of elytra near the sutural part; legs a little longer and slenderer than in female; basal four segments of foretarsus dilated with hair pads on ventral surface.

Genital organ as shown in Figs. 7 and 14–19; aedeagus slender, gently arcuate throughout in lateral view, with the apical lobe narrowly protruded and weakly bent ventrad towards the apex which is obtusely rounded in lateral view; viewed dorsally, apical lobe of aedeagus triangularly elongated, gradually narrowed towards apex which is more sharply pointed than in lateral view, and faintly compressed right laterad; membranous preostium rather narrow, about two-fifths as long as aedeagus; OL large, distinctly and symmetrically bilobed at tip; ligulum indicated by a well sclerotized narrow patch with the distal tip obviously separated from membranous wall, remarkably hooked towards inflexed side of endophallus and sharply pointed at tip like a claw; neither BL nor ML developed on endophallus; PRE indicated by a pair of weakly inflated lobes with the intermediate portion minutely haired and weakly inflated; PP large, distinctly protruded dorsad and asymmetrically bilobed at tip, with the right apical lobe larger than the left in fully everted condition; PAR absent; AL not so large and weakly inflated bilaterally; PL unremarkable; AGG slightly sclerotized and weakly pigmented,



Figs. 8–19. Apical part of aedeagus of *Hemicarabus macleayi* subspp. — 8–12, Subsp. *macleayi* (8, from Nerchinsk, SE. Siberia; 9, from Jakutsk, Yakut; 10, from Gornij, Amur; 11, from Mt. Vachkazhets, Kamchatka; 12, from Mt. Zdanko, C. Sakhalin); 13, subsp. *coreensis* (from “Mt. Paik-yeek-Chan”, North Korea); 14–19, subsp. *amanoi* (from Mt. Rishiri-zan, Hokkaido). Scale: 1 mm.

indicated by a pair of triangularly shaped small terminal plate rather prominently projected towards inflexed side of endophallus.

Female. Length (including mandibles): 17.20–19.10 (M 17.73) mm. Dorsal coloration variable, but maybe included in range of variation between two extremes represented by type specimens, though most specimens collected in 2005 are not so brilliant as in the paratype (cf., IMURA, 2004, p. 236, fig. 2), but usually appear darker and less strongly lustrous as in the holotype (cf., IMURA, 2004, p. 236, fig. 1), or even wholly dark coppery reddish with the elytra bearing a weak greenish tinge. For other details, see the original description of the subspecies.

Larva. General features and chaetotaxy as in other species belonging to the same genus. Body black and strongly polished on dorsal surface; mandibles and legs dark brown; antennae and palpi amber colored and more or less transparent, with distal end of each segment depigmented.

Head transverse subquadrate, about 1.4 times as wide as long, widest at mid-eye level, with the lateral margins rather acutely convergent anteriad, almost parallel-sided behind eyes, and gently convergent posteriad; epistoma with the median tooth of apical margin (=nasale) triangularly protruded anteriad and quadridentate (Fig. 20 b), indicating the type of *Quadricuspides* (LAPOUGE, 1929, p. 49); front angles of epistoma almost equally protruded anteriad as in median tooth, to form subtriangularly shaped large lobes; three pairs of marginal setae inserted, two frontal and one lateral, and three pairs of short setae recognized on discal surface; mandibles rather slender, strongly ar-

cuate inwards throughout, tapering towards apices which are sharply pointed; each mandible with a large retinaculum near the base, which is rather abruptly hooked inwards and sharply pointed at tip; antennae consisting of four segments, with three short setae on distal end of the third and fourth segments.

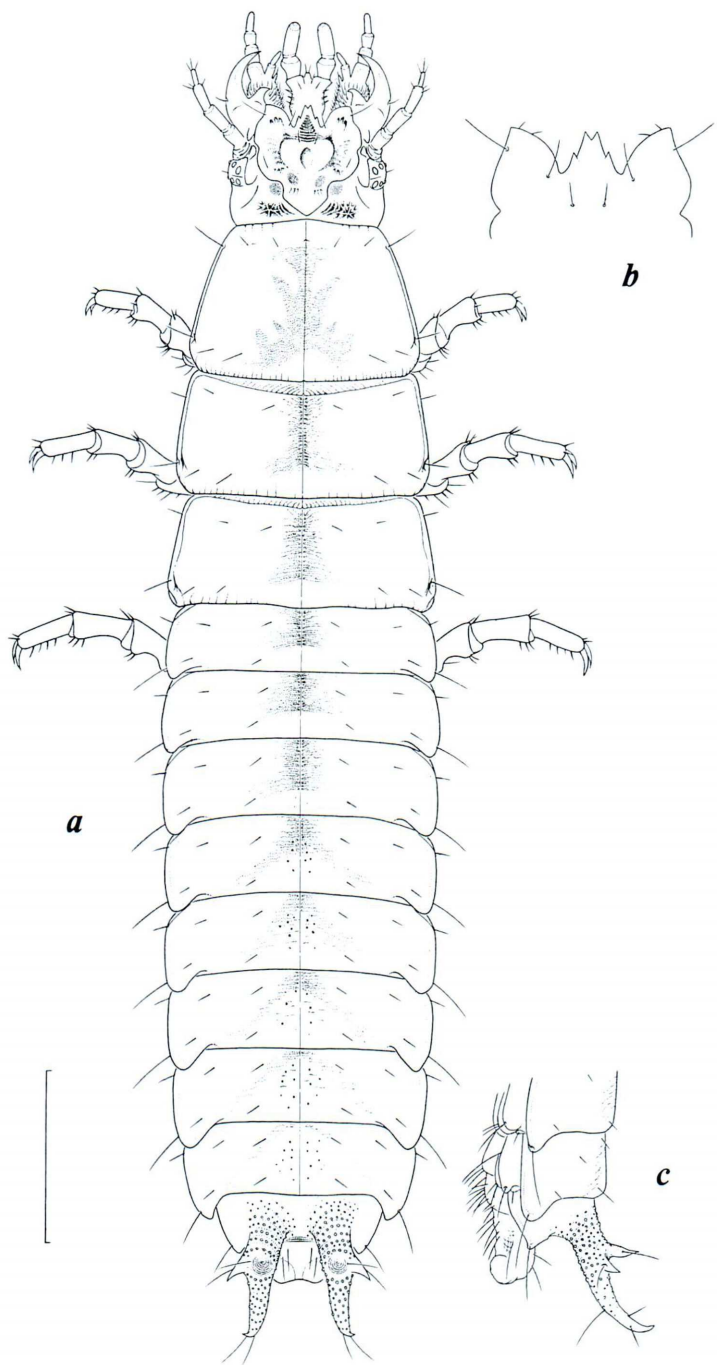
Pronotum trapezoidal, ca. 1.46 times as wide as long and also ca. 1.46 times as wide as head, widest before hind angles which are obtusely rounded; lateral margins almost straightly convergent towards front angles which are subangulate and not protruded anteriorly; front margin slightly protruded at middle and basal margin nearly straight or gently rounded throughout; disc strongly convex above, with the surface almost smooth though minutely rugoso-striate in central portion, and conspicuously guttered along lateral margins; two pairs of short discal setae and longer marginal setae inserted on each side. Mesonotum transverse, ca. 2.25 times as wide as long, widest before hind angles which are obtusely rounded, slightly convergent therefrom towards front angles which are rounded; apical margin rather widely bordered, and lateral margins narrowly but rather deeply grooved; chaetotaxy as in pronotum. Metanotum transverse, ca. 2.57 times as wide as long, with the proportion and chaetotaxy as in mesonotum, though the hind angles are a little more prominently protruded posteriad.

Abdominal tergites I–VIII transverse, 3.98 (in segment I)–2.93 (in segment VIII) times as wide as long; lateral sides of each tergite gradually dilated posteriad in segments I & II, nearly parallel-sided in III–VI, and convergent posteriorly in VII & VIII; hind angles of each segment subtriangularly lobate and protruded posteriad; each tergite with four pairs of short discal setae and two pairs of longer marginal setae; disc strongly convex above, sparsely scattered with fine punctures in segments III–VIII, with the lateral portion narrowly bordered and gently reflexed above, median line narrow but distinct in all eight segments.

Urogomphi a little longer and slenderer than in other species of the same genus, about 3.7 times as long as basal width, widest at bases, gradually tapered towards apices which are sharply pointed, slightly reflexed outside in dorsal view, and rather remarkably reflexed dorsad in lateral view; two accessory horns recognized in median portion, each of them being sharply pointed at tip and unisetiferous; surface coarsely covered with large granules except for apical part where three setae are inserted.

Specimens examined. Imagines (totally 6♂♂, 8♀♀, including the type series): 1♀ (holotype), alpine zone of Mt. Rishiri-zan, on Is. Rishiri-tô, off the western coast of the northern tip of Hokkaido, Northeast Japan, 11~12–VIII–2004, Y. IMURA, N. TODA & Y. NAGAHATA leg., preserved in the collection of the Department of Zoology, National Science Museum (Nat. Hist), Tokyo (NSMT); 1♀ (paratype), same locality, summer of 2001, M. AMANO leg., in coll. Y. IMURA; 6♂♂, 5♀♀, same locality & collectors as for the holotype, summer of 2005, separately preserved in colls. NSMT,

Fig. 20. Third instar larva of *Hemicarabus macleayi amanoi* from the alpine zone of Mt. Rishiri-zan. — a, Habitus in dorsal view; b, apical part of epistoma in dorsal view; c, abdominal tergites VII–IX in left lateral view. Scale: 2 mm for a & c, 1 mm for b.



Rishiri Town Museum and Y. IMURA; 1 ♀, same locality (at a little lower altitude), summer of 2005, Y. IMURA & M. SATO leg., in coll. Y. IMURA. Larvae: 20 exs. (hatched from eggs oviposited by females *in vitro*, and bred by Y. IMURA, Y. NAGAHATA and N. TODA).

Taxonomical notes. Though bearing several peculiar features in the external morphology, the Rishiri race cannot be regarded as an independent species but should be placed under the category of *Hemicarabus macleayi*, viewed from the conformation of the male genital organ as described and illustrated in this paper.

In the original description, I mentioned that the most noticeable character of this beetle might be uniquely shaped elytra, which are apparently slenderer and less acutely convergent towards the apices for the species. This character state appears more distinctly in the male specimens, and doubtless represents the most diagnostic feature of the Rishiri race, as well as relatively slender pronotum and long legs. In addition, the beetle shows its own tendency in coloration of the dorsal surface. In the Rishiri population, dorsal surface of the elytra more or less bears a reddish tinge above all in the central portion near the sutural part, and no purple-colored individual is found, though the latter form is often predominant or appears by a certain ratio in most populations occurring in other regions with a few exceptions such as North Korea and Kamchatka. As mentioned in the redescription given above, elytral intervals of the Rishiri specimens are uniquely sculptured and could be useful as one of the main diagnostic characters. In the original description of subsp. *amanoi*, I have stated that “its elytral sculpture is also unique in having more strongly developed secondary and tertiary intervals” (IMURA, 2004, p. 238). However, this expression is inappropriate. Examining totally fourteen specimens, I have apprehended that the most noticeable is rather narrowly but prominently convex primary costae showing a striking contrast to much reduced tertiary intervals which are usually recognized as irregularly set rows of the granules. In the nominotypical *macleayi*, the tertiary intervals are almost equally elevated as in the secondaries, often longitudinally contiguous to form irregularly segmented costae, and more frequently fused with the adjacent intervals to form reticularly uneven elytral surface. In subsp. *corensis*, the sculptural pattern is similar to that of the Rishiri race, but the former is readily discriminated from the latter by having much wider primaries indicated by rows of large callosities and much more reduced secondaries often indicated by rows of the granules. The aedeagal apex is considerably variable in the shape according to individuals as shown in Figs. 14–19. However, it is always a little shorter and robuster on an average than that of other populations (width/length 2.25–2.55 (M 2.39) in the Rishiri specimens, whereas it is 2.80–3.32 (M 2.99) in those from other localities), and it could be regarded as one of the diagnostic characters. Thus, the population of *H. macleayi* occurring on Rishiri-tô bears several important peculiarities and is safely regarded as a good subspecies.

Larva of *Hemicarabus macleayi* is illustrated and described for the first time in the present paper, so far as I have ranged extensively over the literature. General features are almost the same as those in three other species of the genus which have been

described and/or illustrated in past papers (cf., LAYNAUD, 1975, pp. 308, 310, on *H. nitens* & *H. serratus*; SUGIE & FUJIWARA, 1981, on *H. tuberculosus* (not yet published); ARNDT *et al.*, 2003, pp. 139, 145, on *H. nitens*), and the former is barely discriminated from the latter three in the following respects: 1) median tooth, or nasale, of epistoma longer and slenderer, more strongly protruded anteriad, with the tip less deeply re-entrant at middle; 2) urogomphi also a little longer and slenderer. We now know that all the four described species of *Hemicarabus* are thus quite homogeneous in the larval morphology, and it is suggested that they are phylogenetically much closer than has been imagined from the external appearance which is considerably different from one another. This is not consistent with a hypothesis deduced from the molecular phylogenetic study by analyzing mitochondrial DNA (IMURA *et al.*, 2000).

Bionomical notes. Of the total twelve specimens obtained during the 2005 survey in the field, ten were collected by baited pitfall traps set in a narrow gravelly slope. The slope is very steep and frequently accompanying small-scale landslides here and there. In such a harsh condition, *H. m. amanoi* selectively inhabits the environment with the ground surface covered by low grasses, alpine mosses and lichens, so that the top soil is rather stable. One of the remaining two specimens was trapped in a grassy slope mainly composed of *Calamagrostis*, located at a little lower altitude. The final one was found in the daytime walking across a narrow barren terrace formed by dry sandy soil of volcanic origin, located near the periphery of the main habitat. As was expected in my previous paper (IMURA, 2004, p. 239), *H. m. amanoi* seems to be confined to such a strictly narrow environment now only partly extant near the summit of Rishiri-zan, and in most cases it is very dangerous even trying to approach there.

As is observed in other species belonging to the same genus, the present race seems to be a typical spring breeder, and has its main activity peak early in the summer in the alpine zone of Rishiri-zan, since the habitat is usually covered with snow until late in the spring. Reproduction is considered to take place in that season during a period of high locomotory activity of the adults. It is still uncertain whether this race has a two-peaked curve of activity both early and late in the summer, as is reported in other congeners of *Hemicarabus* (cf., TURIN *et al.*, 2003, p. 204).

According to the observation made in a cage, the adult beetle can accept various kinds of food, such as small scarabaeid beetles, caterpillars of alpine moths, ground spiders, snails, raw meat and several kinds of fruits, etc. On the other hand, the larva seems to be specialized to a predator of fresh insects. Above all, they prefer to eat small scarabaeid beetles such as *Sericania sachalinensis*, one of the dominant beetles in the alpine zone of Rishiri-zan during the activity peak of *H. m. amanoi*, or *Popillia japonica* as a substitute food *in vitro*. Also they prefer to feed on maggot (larva of *Phaenicia cuprina*) usually supplied as bait for fishing.

The larvae pass through three stages until pupation, so that the third one is the last instar. Preimaginal development takes 1–1.5 months under the room temperature of about 20°C.

要 約

井村有希：リシリノマックレイセアカオサムシに関する追加知見。—— リシリノマックレイセアカオサムシは、2004年の秋に利尻島の高所から新亜種として記載され、久びさに発見された日本未記録種のオサムシとして注目を集めた。しかしながら、記載された時点では、わずか2点の♀が知られていたにすぎず、分類学的に不可欠な♂が未知であったうえ、その分布状況や生息環境、生態に関しても不明な点が多かった。これらを解明するべく2005年度に行われた第二次調査により、♂を含む12点の標本があらたに得られ、より詳細な分布状況や生息環境、生態とともに、飼育によりその幼生期の全貌をもあきらかにすることができた。本論文では、♂とその交尾器所見を含む成虫の再記載、ならびに終令幼虫の図示・記載を行い、あわせて本種の分布や生息環境、生態についても簡単に触れた。♂を含む複数個体について詳細に検討をくわえたところ、利尻島の集団は外部形態、交尾器形態ともに他集団との間に一定の差が認められ、独立した亜種としての特徴をそなえていることが再認識された。また、より広範な調査の結果、その生息範囲はきわめて限られていて、原記載論文において予報的に指摘されたように、本種が利尻山高所に残された特殊な環境のみに細々と命脈をたもっていることはほとんど疑う余地がない。現地における観察ならびに人為的環境下における飼育結果から、その生活史は同属各種と同じく春繁殖型と思われ、成虫は比較的雑食性で他の昆虫や蜘蛛類、カタツムリ、果物などを食するが、幼虫は小型のコガネムシ類や双翅目の幼虫などを主たる食餌資源として利用しているらしいことが判明した。幼虫は頭部鼻上板前縁中央突起の形態が四齒型を呈し、3令が終令で、飼育下では産卵から羽化まで1~1.5箇月を要した。

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